Virtual Proving Ground
Real Benefits

Darrell Bench

PM Virtual Proving Ground

U.S. Army

Developmental Test Command

17 April 2002

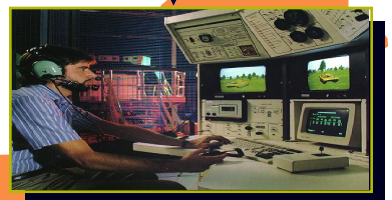
Quality Control for the US Arm

Virtual Proving Ground

V & V
Live Test
Supporting M&S

Hardware Test
Real Range

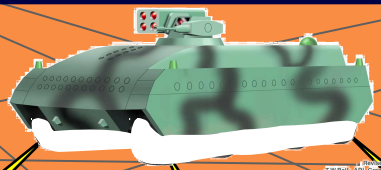
Hardware-in-the-loop
Human-in-the-loop



Virtual Test,
Prototype,
& Range

System of Systems

Distributed Capability



Natural Environments

Synthetic Environment

Live

Virtual

Constructive

SAMPLE APPLICATIONS

- Force XXI Battle Command Brigade and Below (FBCB2)
- High Mobility ¼ Ton Trailer
- Longbow Launcher Circuit Card Assembly
- UH-1 Vertical Stabilizer
- Unmanned Ground Vehicle (UGV)
- Crusader Transportability

FBCB2 Test Simulation Support

TEST PLANNING, CONTROL, & MONITORING CELL

STARSHIP/STARGEN

STIMULATION/ SIMULATION

- MESSAGE TRAFFIC LOADING
- VOICE LOADING
- LIVE OPERATORS
- SIMULATED ENTITIES
- STORM
- DAUVS
- JEM/MCREWS

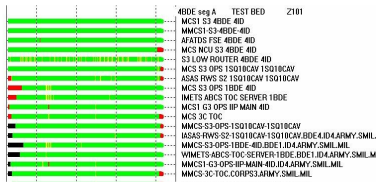
DATA COLLECTION

- INFO EXCHANGE DATA
- PROTOCOL DATA
- SYSTEM PARAMETERS
- DATABASE INFO

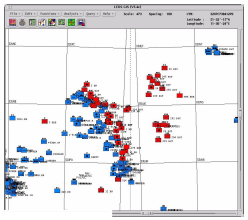
REDUCTION & ANALYSIS

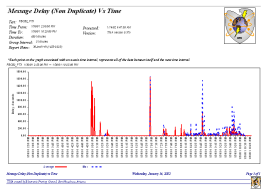
- TECHNICAL PERFORMANCE
- OPERATIONAL LEVEL III
- AFTER-ACTION REPORTS
- DPU
- RTA

PRODUCTS



Near RT Status

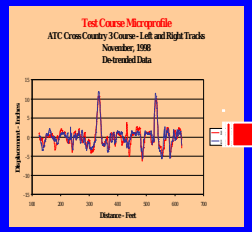




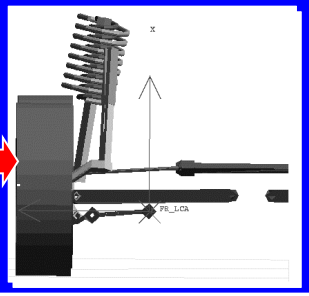
High Mobility ¼ Ton Trailer (ATC)

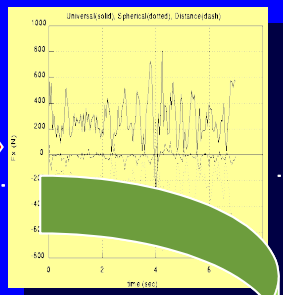
Pro/E

Terrain Model



System Model Dynamics Analysis

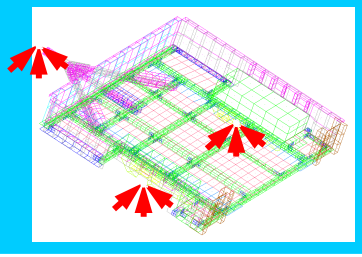




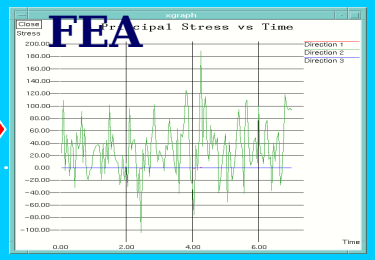
DADS

Component Stress

FE Model



FEA

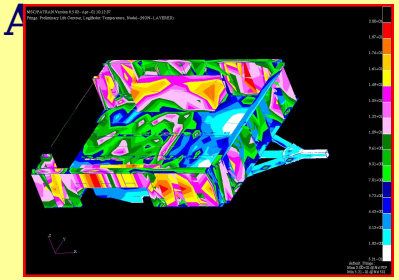


NASTRAN

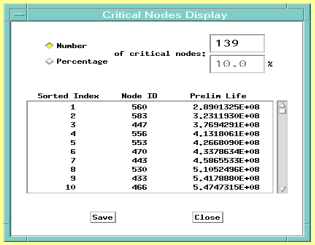
Reliability Analysis

DRAW

Fatigue Life Analysis



List of Critical Nodes

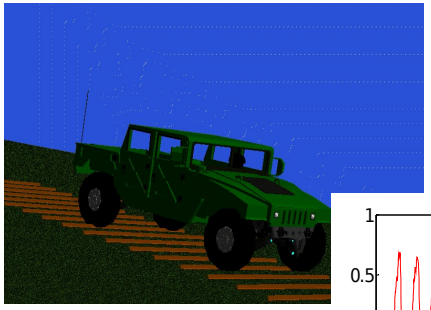


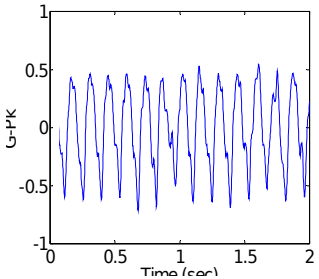
Reliability Based Design Optimization

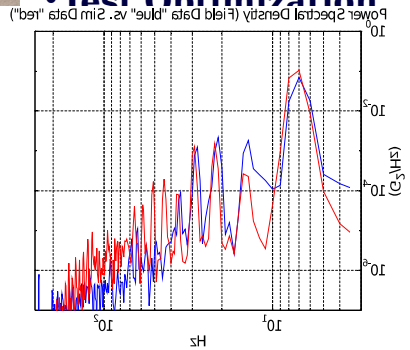
HMMWV Dynamic M&S (RTTC)

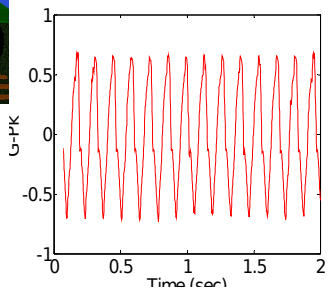
Dynamic Simulation

- **Environment Prediction**
- **Model Verification**
- **Test Optimization**

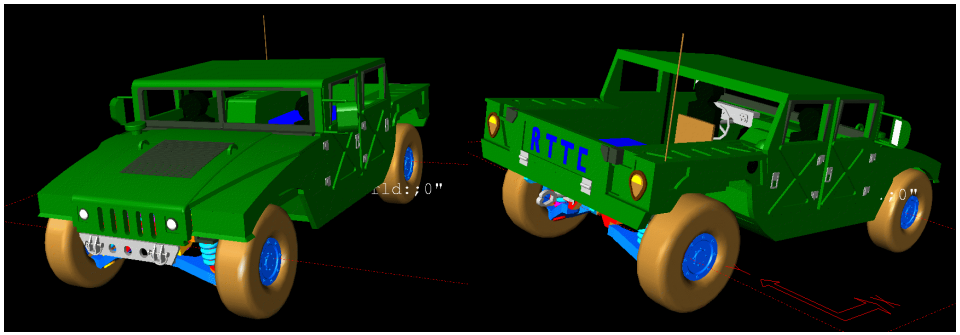


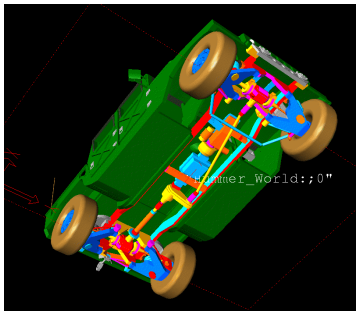


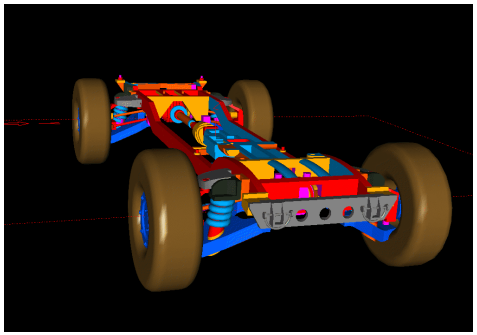




10 MPH Acceleration Comparison



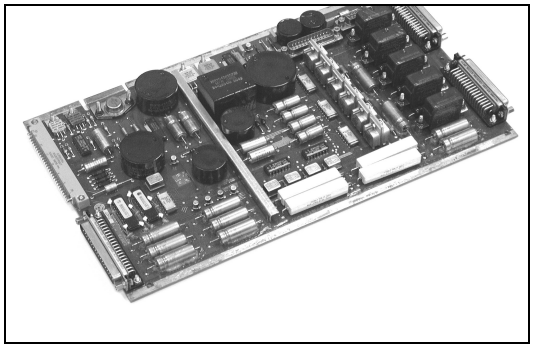


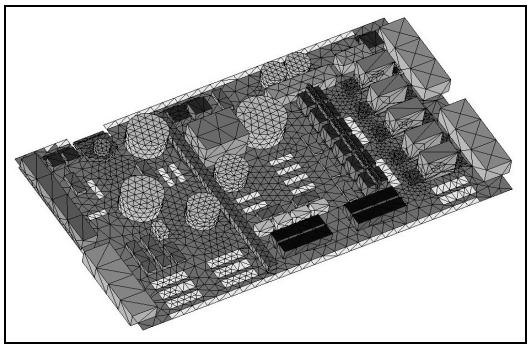


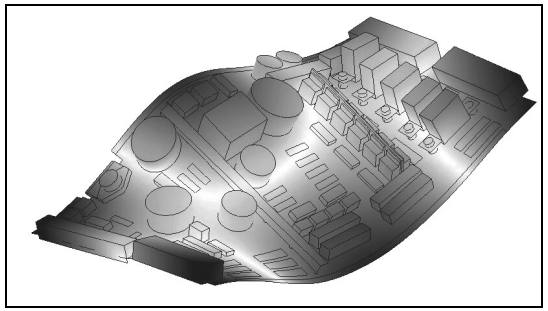
Integration of Flexible Component

Tool allows testing earlier in the development cycle (pre-prototype), allows for the development of the operational environment specification without expensive field tests, and supports the use of VPG to design and optimize the physical test.

Longbow Launcher Power Supply Circuit Card Assembly Modeling (RTTC)







- Design Evaluations and Proposal Comparisons
- Assess Improvements In Circuit Card Durability
- Damage Accumulation Analysis (Using Equivalent Qualification Level Thermal and Dynamic Loads Applied to the Model as Individual Events)
- Assess Alternative Test Profiles
- Assess Failure Potential in Fielded Unit

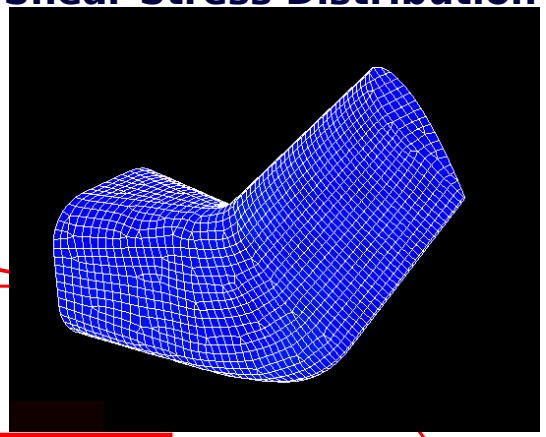
Provide a Reliable Assessment of Stresses During Dynamic Environments Using a Validated (Installed and Free Form) Finite Element Model (FEM) of the Circuit Card Assembly

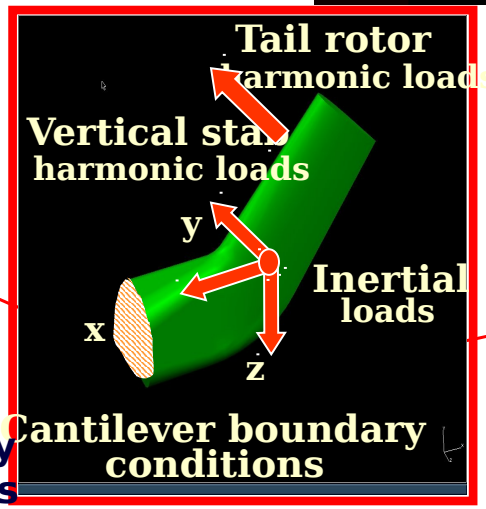
Flight Test Simulation Station (ATTC)

Dynamic Load Analysis

UH1 Vertical Stabilizer Separation

Shear Stress Distribution





FTSS used to Assess Dynamic Loads on the UH-1 Vertical Stabilizer prior to Flight Testing

- FTSS used to Identify and explore Hazardous Flight Conditions

- FTSS Helps to Ensure the Safety of Fight Testing through Analysis

Notes:

- UH-1 accident: Vertica Stabilizer (tail fin) separated in-flight
- AMCOM issued ASAM Fleet wide grounding
- FTSS: used NASTRAN and Flight Lab Model of UH-1 to determine Stress Distributions

Unmanned Ground Vehicle Distributed Test Concept

XUV: Experimental Unmanned Vehicle

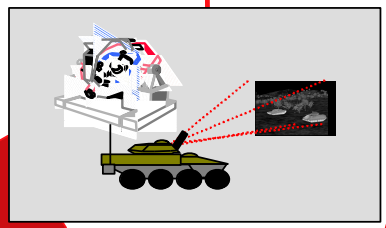
Maneuver Support Center
Armor Center

AMCOM RDEC:
UGV Virtual Driving Station

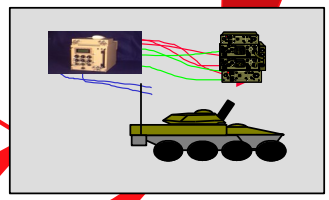
UGV

Physics Based Virtual Environments

DPG: Chemical Environments & J SLSCAD Standoff Chemical Sensor



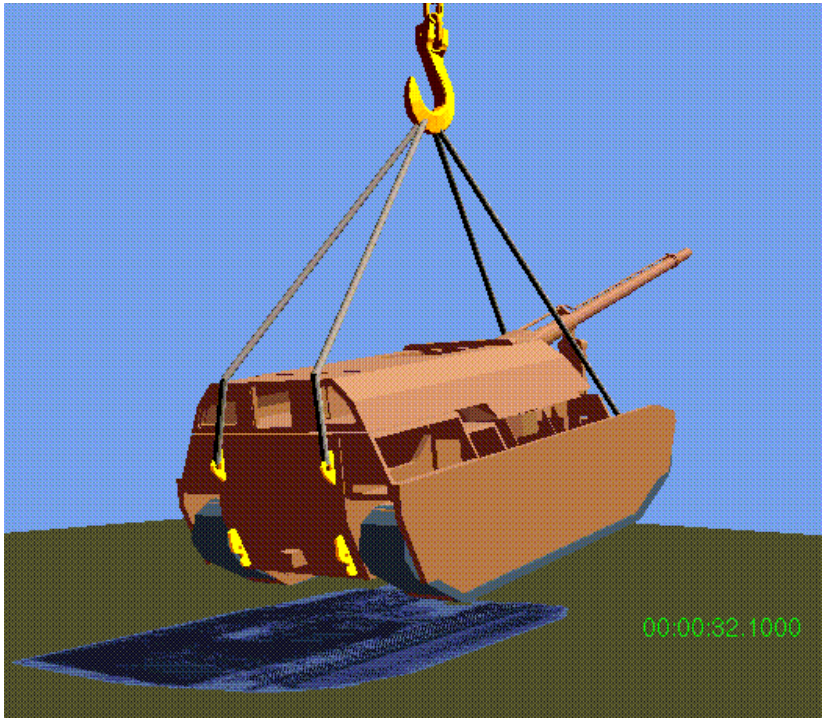
RTTC: IR Environment & DIRSP, HWIL RSTA FLIR, Virtual Range for FLIR



WSMR-EPG: RF Data Link Effects

REDESIGN FOR TRANSPORTABILITY BEFORE PROTOTYPING

TRANSPORTABILITY TESTING CRUSADER



- **Rail Impact**
- **Loading & Fit**
- **Lifting & Tie-down**
- **Partnership w/ MTMC & UDLP**

Summary

- **VPG is supporting testing now!**
- **VPG is strategically planning to use M&S to support FCS and the OF.**
- **DTC's investment priority is to facilitate synthesis of data into knowledge.- SMART Testing**


Testing is key to successfully fielding the digitized force.
M&S is key to fielding expeditiously.